P21094.P01

Rec'd PCT/PTO 13 JUN2001

Form PTO-1390	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER P21094
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/856495
INTERNATIONAL APPLICATION NO. PCT/EP99/09479	INTERNATIONAL FILING DATE 03 December 1999	PRIORITY DATE CLAIMED 14 December 1998

TITLE OF INVENTION

CERAMIC MULTILAYER FILTERS AND METHOD FOR PRODUCING THE SAME

APPLICANT(S) FOR DO/EO/US

Jörg ADLER, Reinhard LENK, and Hans-Jürgen RICHTER

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1. _X_ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. ___ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. _X_ This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)).
4. _X_ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. _X_ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. _X_ is attached hereto (required only if not communicated by the International Bureau).
   b. _X_ has been communicated by the International Bureau.
   c. ___ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ___ An English language translation of the International Application as filed (35 U.S.C. 371 (c)(2)).
7. ___ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ___ are attached hereto (required only if not communicated by the International Bureau).
   b. ___ have been communicated by the International Bureau.
   c. ___ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ___ have not been made and will not be made.
8. ___ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3))
9. _X_ An oath or declaration of the inventor(s) (35 U.S.C. .371(c)(4)).
   "Unexecuted"
10. ___ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (U.S.C. 371(c)(5)).

Items 11 to 16 below concern other document(s) or information included:

11. Assignee: FRAUNHOFER-GESELLSCHAFT ZUR FÖRDERUNG DER ANGEWANDTEN FORSCHUNG E.V. of München, GERMANY
12. ___ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
13. ___ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
14. ___ A FIRST preliminary amendment.
    ___ A SECOND or SUBSEQUENT preliminary amendment.
15. ___ A substitute specification.
16. ___ A change of power of attorney and/or address letter.
17. ___ Figure of Drawing to be published_____
18. _X_ Other items or information:
    Cover Sheet and International Application as published in German.
    PCT/IB/301.
    PCT/IB/304.
    PCT/IB/308.
    PCT/IB/332.
    PCT/ISA/210.
    PCT/IPEA/416(in German).
    PCT/IPEA/409(in German).
    Cover Letter under 35 USC 371 and 1.495.
    Claim of Priority.

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U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/856495	INTERNATIONAL APPLICATION NO. PCT/EP99/09479	ATTORNEY'S DOCKET NUMBER P21094

19. ___ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)):		
Search report has been prepared by the EPO or JPO. . . . . $ 860.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482). . . . . $ 690.00		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO(37 CFR 1.445(a)(2). . . . . $ 710.00		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO. $1,000.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4). . . . . $ 100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$860.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ___ 20 ___ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

Claims	Number Filed	Number Extra	RATE		
Total Claims	- 20 =		X $18.00	$	
Independent Claims	- 3 =		X $80.00	$	
Multiple dependent claim(s) (if applicable)			+ $270.00	$	
			TOTAL OF ABOVE CALCULATIONS =	$860.00	
___ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.				$	
			SUBTOTAL =	$860.00	
Processing fee of $130.00 for furnishing the English translation later than ___ 20 ___ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +					
Extension of Time fee in the amount of $					
			TOTAL NATIONAL FEE =	$860.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property +					
			TOTAL FEES ENCLOSED =	$860.00	
			Amount to be refunded	$	
			Charged	$	

a. _X_ A check in the amount of $860.00 to cover the above fees is enclosed.

b. ___ Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees.

c. _X_ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 19-0089.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO **CUSTOMER NO. 7055**
AT THE PRESENT ADDRESS OF:
Neil F. Greenblum
GREENBLUM & BERNSTEIN, P.L.C.
1941 Roland Clarke Place
Reston, VA 20191
(703) 716-1191

SIGNATURE
Neil F. Greenblum 43,563
NAME

28,394
REGISTRATION NUMBER

P21094.A01

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Jörg ADLER et al.

Group Art Unit: UNKNOWN

Appl. No. : 09/856,495

Examiner: UNKNOWN

I.A. Filed : December 3, 1999

For : CERAMIC MULTILAYER FILTERS AND METHOD FOR PRODUCING THE SAME

PRELIMINARY AMENDMENT

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

Prior to calculation of the fees and an examination of the above-identified patent application, the Examiner is respectfully requested to amend the application as follows:

IN THE CLAIMS

Please amend claim 9 as follows (a marked-up copy of the changes is attached to the present amendment):

9. (Amended) Process for producing a ceramic multi-layer filter according to claim 1, in which at least two ceramic slurries are manufactured from at least two ceramic powders of the same or different composition but different particle sizes with the additional of known forming and sintering auxiliary agents, where the particles of the ceramic powders are wet with a material or a material is added to the ceramic slurries in powdered form, which wets the surface of the ceramic particle well with a temperature increase and has the same or approximately the same thermal

coefficient of expansion as the ceramic particles, and which does not or only slightly alters the particle size, particle morphology and particle composition/crystal structure compared to those of the powder that is used and which forms spot and/or surface connections in the case of a temperature change between the particles, where the material is only added in the quantity or in the quantity that coats the ceramics particles so that the pore quantity and pore size between the particles is reduced by the material only slightly or only partially but not more than 50%, one or more layers are formed and dried from the slurries, where, after partial or complete drying of a layer, another layer with ceramic particles with a smaller particle size than the already dried layer can be formed on it, and at least two layers are placed over one another and/or connected with one another and jointly subjected to a temperature increase, which leads to the formation of the spot and/or surface connection between the ceramic particles by the material.

REMARKS

The Examiner is respectfully requested to enter the foregoing amendment to remove multiple dependent claims prior to examination of the above-identified patent application.

The amendments to the claims made in this amendment have not been made to overcome the prior art, and thus, should be considered to have been made for a purpose unrelated to patentability, and no estoppel should be deemed to attach thereto.

P21094.A01

Should there be any questions, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
Jörg ADLER et al.

Neil F. Greenblum
Reg. No. 28,394
Reg No. 33,094

September 24, 2001
GREENBLUM & BERNSTEIN, P.L.C.
1941 Roland Clarke Place
Reston, VA 20191
(703) 716-1191

MARKED-UP COPY OF CHANGES TO CLAIM 9:

9. (Amended) Process for producing a ceramic multi-layer filter according to [one of claims 1 through 8] claim 1, in which at least two ceramic slurries are manufactured from at least two ceramic powders of the same or different composition but different particle sizes with the additional of known forming and sintering auxiliary agents, where the particles of the ceramic powders are wet with a material or a material is added to the ceramic slurries in powdered form, which wets the surface of the ceramic particle well with a temperature increase and has the same or approximately the same thermal coefficient of expansion as the ceramic particles, and which does not or only slightly alters the particle size, particle morphology and particle composition/crystal structure compared to those of the powder that is used and which forms spot and/or surface connections in the case of a temperature change between the particles, where the material is only added in the quantity or in the quantity that coats the ceramics particles so that the pore quantity and pore size between the particles is reduced by the material only slightly or only partially but not more than 50%, one or more layers are formed and dried from the slurries, where, after partial or complete drying of a layer, another layer with ceramic particles with a smaller particle size than the already dried layer can be formed on it, and at least two layers are placed over one another and/or connected with one another and jointly subjected to a temperature increase, which leads to the formation of the spot and/or surface connection between the ceramic particles by the material.

Ceramic Multi-layer Filters and Process for Producing the Same

The present invention relates to the area of filter technology and ceramics and concerns ceramic multi-layer filters and a process for their manufacture, like those that can be used, for example, to separate oil-water emulsions in metal cutting fabrication, to clarify beer, to purify gas, to split gas or to separate liquid-solid mixtures.

Despite the commercial successes of ceramic UF/MF membranes in recent years and the continuing growth of demand, a substantial disadvantage remains as compared to the much more prevalent polymer membranes: the relatively high price per filter surface.

Ceramic filter materials are normally built up of sintered-together particles whose interstices form the porosity. Obtaining the highest possible proportion of pore volume and the most uniform and closely distributed pore size distribution possible is required for filtration purposes. As a result, it is preferred for ceramic powder with a closely distributed grain size distribution to be used for manufacturing ceramic filter materials since these offer the best of the above-mentioned properties. Powders with closely distributed grain size distribution are known and standardized from the abrasives industry.

Normally, ceramic membranes are made of a multi-layer system of porous ceramic whose individual layers have different pore widths. The actual filtering layer is the thinnest and most micro-porous of the system. It is situated on a coarsely porous and thicker layer, and this in turn on the next layer, etc. The coarsely porous material forms the support, which simultaneously assumes the mechanic carrier function of the overall system and also frequently forms the filtrate collection structures. The intermediate layers between support and layer serve to reduce the interstices between the coarse particles of the support and the support of the finer particles of the subsequent layer. Depending upon the desired size of separation, at least one layer, but most of the time at least two layers are currently applied on the support for micro-filtration membranes (size

of separation 1000 nm to 200 nm), at least two, but for the most part more than three layers are applied on the support for ultra-filtration membranes (size of separation 100 nm to 10 nm) and more than three layers are applied on the support for nano-filtration membranes (size of separation less than 10 nm).

Manufacturing the above-mentioned ceramic membranes takes places by first forming, drying and firing the support, then the first layer is applied, dried and fired, then the next layer is applied, etc. until the layer made of the finest particles is applied, the layer formed is dried and fired. The sintering takes place in accordance with the degree of fineness of the coating with much lower temperatures than with the support.

The majority of the cost in manufacturing arises due to the multiple repetition of the cycle "coating, drying, sintering." The thermal treatment steps within the process chain are already the most expensive as such so that multiple repetition increases this share immensely. In addition, a cost-intensive manual effort arises along with the other steps.

The joint sintering of ceramic layers made of different ceramics has been known as such for a longer period of time from the fabrication of ceramic multi-layer elements for applications in microelectronics. The term LTCC for "low temperature cofiring ceramics" was coined for this.

However, in this case, layers of different ceramics that have different properties (such as insulating and conductive) are sintered with one another with the goal of achieving the highest possible density of the layers (for example, US 3978248, US 5683528).

On the other hand, in the case of ceramic filter elements, the most similar ceramic layers possible, differing from one another only in terms of their pore sizes, are supposed to be sintered jointly. According to the above-mentioned principle of manufacturing porous ceramics, this means that layers of the same ceramic, but with different degrees of grain fineness, must be sintered jointly.

The main problem with cofiring is the different sinter activity of variously fine powders as a result of difference volume/surface relations. As a result, coarse powders require very high temperatures for a stable grain-grain connection, which originates via surface diffusion or via evaporation or condensation mechanisms.

In the case of very fine powders, on the other hand, the sintering activity is so high that, with equally high temperatures as a result of volume diffusion, a strong densification takes place that is accompanied by grain growth. In this connection, the pore volume diminishes and the pore size distribution shifts in the direction of larger pores. This process is associated with a high volume shrinkage, while the grain-grain bond subsides in the case of coarse powders with lower shrinkage.

But even slight differences in the shrinkage of multi-layer elements with simultaneous sintering lead to a distortion of the multi-layer element or to internal strains that reduce the mechanical load-bearing capacity. In addition, the shrinkage itself is undesired since it leads to changes in the dimensions of the ceramic formed pieces that are difficult to reproduce and make expensive refinishing steps necessary in order to be able to comply with narrow dimensional tolerances.

According to WO 96/30207, a process is known in which the shrinkage adaptation of a component of a multi-layer system is achieved by the use of nanoscale powders. In the case of coarsely porous filters, coarse powders are used and the nanoscale powder is added to the mixture to promote its fusion, while, the case of fine powders, the nanoscale powder itself is used and sintering inhibitors are added in order to prevent fusion that is too strong. Agglomerates of the nanoscale powder are also used as coarse powder.

Disadvantageous in the case of this process, however, is the fact that precisely coordinating the shrinkage of the individual components requires relatively expensive experiments, the processing of nanoscale powders is very expensive (for example in the case of dispersion), and the powders are very expensive. In addition, the mixing of powders with different degrees of fineness causes a reduction in the pore volume, which

is undesirable for filter applications.

The variations for multi-layer filters cited in the exemplary embodiments mention shrinkages of 5% for the support and 4% for the layer, which leads to great problems in practical application.

According to WO 90/15661, a simultaneously sintered two-layer filter is known in which the sintering behavior of the support (called "membrane" in this case) is adapted to the sintering behavior of the layer (called "film" in this case) by a fine powder fraction being added to the coarse powder (4 nm up to 10% of the diameter of the coarse particles) and/or a sintering auxiliary agent being used in order to adapt the sintering temperature of the support to that of the layer.

In this connection, the problem also occurs, however, that the pore volume of the support is reduced by adding the fine powder fraction and coordinating the shrinkage of the layer to that of the support requires expensive experimentation. The difficulty of the process becomes clear in that the shrinkage of the film is supposed to be reduced additionally by high solid loading of the powder dispersion, which is particularly difficult to achieve in the case of fine powders. In addition, the sintering is conducted under pressure load in order to prevent distortion. The shrinkages of the overall system cited in the exemplary embodiments lie between 4 and 11%.

As a whole, two principle problems can be recognized that occur in the case of joint sintering of layers of different grain fineness with the same (low or high) temperature:

a) The different bond strengths of the powder particles i.e., in the case of high temperature, good bonding of the support, but strong sintering of the layer; in the case of low temperature, good formation of the layer but poor bonding of the support (as a consequence, for the purpose of avoiding these problems, every layer type is fired at different temperatures, which differ up to 1200 K).

b) The different shrinkage, which leads to crack formation and delaminations in the layer.

Problem b) leads to very special requirements being placed on layer structure in order to avoid cracks and delaminations. Thus, the following is cited in R.R. Bhave, Characteristics and Application, Van Nostrand Reinhold, New York, 1991:

- The layers must be very thin (MF membranes between 25 and 50 μm, UF under 10, to some extent under 5 μm).
- The roughness of the support should be low.
- Significance is attached to the grain shape of the coating powder.

The invention is based upon the objective of disclosing ceramic multi-layer filters, which can be simultaneously sintered despite different particle sizes of the powders in the individual layers, and which can be manufactured in a more cost-effective manner as a result.

The ceramic multi-layer filters in accordance with the invention are manufactured in accordance with the invention by the sintering temperature and material system being selected in such a manner that the powders used remain passive, i.e., that their size, morphology, and composition/crystal structure does not or only negligibly alters. The bonding of the particles takes place during sintering via an additional liquid phase, which encases the powder particles and connects on the contact surfaces. This liquid phase must be coordinated with the sintering temperature and the material system in such a way that

- The liquid phase has a low viscosity with the selected sintering temperature and good wetting of the powder takes place.
- The liquid phase enters into no reactions or only slight reactions with the powder.
- The liquid phase itself has an increased surface tension in order to avoid being absorbed into the capillary system of the pores.

Of particular advantage in the case of the solution proposed in accordance with the invention is that, when manufacturing the multi-layer filters, no or only a very low shrinkage occurs, essentially ≤ 1%, for the entire layer compound and also no or only very slight differences occur in the shrinkage of the individual layers.

In addition, in the case of the solution proposed in accordance with the invention, no reduction of the pore volume occurs due to adapting the shrinkages of the different layers, like that which inevitably takes place according to the state of the art with all known processes via the process guidance selected in the particular case. As a result, manufacturing filters using the process in accordance with the invention is particularly advantageous.

Advantageous in particular in the case of a high degree of fineness of the particles is a homogenous distribution of the liquid phase during preparation and a homogenous deposit during drying, as much as possible on the surface of the particles. Thermal or chemical methods of surface coating of powders (possibly co-precipitation) are possible for very fine powders.

It is advantageous for silicon carbide powder to be selected as the ceramic powder and for a borosilicate glass to be selected as the liquid phase that occurs during sintering.

It is also advantageous for aluminum oxide powder to be selected as the ceramic material and for an aluminum borosilicate glass or a lithium aluminum silicate glass to be selected as the liquid phase that occurs during sintering.

It is also advantageous if the liquid phase that occurs during sintering partially or completely crystallizes during cooling.

Commercial, closely fractionated abrasive powders are advantageously used as ceramic powders.

Advantageously, the sintering is conducted under air and advantageously at temperatures between 700 and 1200° C.

The invention is explained in more detail in the following on the basis of several exemplary embodiments.

Example 1

900 g of a silicon carbide abrasive powder F500 (average particle size 30μm) is mixed with 100 g of a finely ground borosilicate glass (average particle size 2 μm), the mixture is processed with the standard auxiliary agents (PVA, PEG) into a film-casting slurry and processed from this on a film-casting bench into a ceramic foil with a thickness of 0.5 mm. A second film-casting slurry, which is produced from 90 g of a silicon carbide abrasive powder F1000 (average particle size 4.5 μm) with 10 g of the borosilicate glass powder and the standard auxiliary agents, is applied to the film that is beginning to dry so that a second 50 μm thick film originates on the first film. The originated two-layer film is dried using the usual methods, divided up into individual pieces of 100 x 100 mm and released and then sintered 90 minutes at 800° C under air. A sintered two-layer ceramic flat membrane originates, whereby both layers have an open pore volume of 35 to 40%, the thick, coarsely porous layer has an average pore diameter of 8 μm and the thin, micro-porous layer has an average pore diameter of 1 μm. The shrinkage of the two-layer film is less than 0.1% and the sintered two-layer film is completely even.

Example 2

850 g of an aluminum oxide powder with an average grain size of 50 μm is mixed with 150 g of a finely ground lithium aluminum silicate glass powder (average grain size 3 μm), the mixture is processed with the standard auxiliary agents (PVA, PEG) into a film-casting slurry and processed from this on a film-casting bench into a ceramic foil with a thickness of 600 μm. A second film-casting slurry, which is manufactured from aluminum oxide powder with an average grain size of 5 μm and 15 g of the above-mentioned lithium aluminum silicate glass powder, which was ground to an average grain size of approximately 1 μm, and the standard auxiliary agents, is applied to the film that is beginning to dry so that a second 50 μm thick film originates on the first film. The originating two-layer film is dried using the usual methods, divided up into individual pieces of 100 x 100 mm and released, and then sintered 60 minutes at 950° C under air. A sintered two-layer ceramic flat membrane originates, with both layers having an open pore volume of 35 to 40%, the thick, coarsely porous layer having an average pore

diameter of 10 μm and the thin, micro-porous layer having an average pore diameter of approximately 1 μm. The shrinkage of the two-layer film is < 0.1% and the sintered film is completely even.

Claims

1. Ceramic multi-layer filter made of at least two layers of the same or different ceramic materials with a different particle size of the ceramic particles in the individual layers, where one layer is a support layer and at least one other layer is present as a layer with ceramic material with a smaller particle size, in which the particle surfaces of all ceramic particles in the layers are wet entirely or partially with at least one material, which wets the surface of the ceramic particles well and has the same or approximately the same thermal coefficient of expansion as the ceramic particles, and the particle size, particle morphology and particle composition/crystal structure is not altered or only slightly altered compared to those of the powder that is used and in which spot and/or surface connections are formed between the particles, where the pore volume and pore size between the particles is reduced by the material only slightly or only partially but not by more than 50%.

2. Ceramic multi-layer filter according to claim 1, in which, when forming more than two layers as layers on the support, the particle size of the ceramic material diminishes in the direction going away from the support.

3. Ceramic multi-layer filter according to claim 1, in which the ceramic particles of the support layer and at least the one additional layer are comprised of layers of the same ceramic material, preferably silicon carbide or aluminum oxide.

4. Ceramic multi-layer filter according to claim 1, in which the ceramic material in all layers of the filter and the material which wets the surfaces of the ceramic particles, possess the same composition in all layers of the filter.

5. Ceramic multi-layer filter according to claim 1, in which the material that wets the surface of the ceramic particles and forms the spot and/or surface connection between the ceramic particles is a borosilicate glass or an aluminum borosilicate glass or a lithium aluminum silicate glass.

6. Ceramic multi-layer filter according to claim 1, in which the quantity of material, which wets the surface of the ceramic particles and forms the spot and/or surface connection between the ceramic particles, is selected in terms of size in such a way that the pore volume and the pore size between the particles is reduced only slightly by the material, preferably not more than 10%.

7. Ceramic multi-layer filter according to claim 1, in which the ceramic particles of at least two layers differentiate from one another in a ratio of 1 : 5 to 1 : 10 in terms of their average particle size.

8. Ceramic multi-layer filter according to claim 1, in which the particles of the support layer have an average particle size of 20 to 50µm.

9. Process for producing a ceramic multi-layer filter according to one of claims 1 through 8, in which at least two ceramic slurries are manufactured from at least two ceramic powders of the same or different composition but different particle sizes with the additional of known forming and sintering auxiliary agents, where the particles of the ceramic powders are wet with a material or a material is added to the ceramic slurries in powdered form, which wets the surface of the ceramic particle well with a temperature increase and has the same or approximately the same thermal coefficient of expansion as the ceramic particles, and which does not or only slightly alters the particle size, particle morphology and particle composition/crystal structure compared to those of the powder that is used and which forms spot and/or surface connections in the case of a temperature change between the particles, where the material is only added in the quantity or in the quantity that coats the ceramics particles so that the pore quantity and pore size between the particles is reduced by the material only slightly or only partially but not more than 50%, one or more layers are formed and dried from the slurries, where, after partial or complete drying of a layer, another layer with ceramic particles with a smaller particle size than the already dried layer can be formed

on it, and at least two layers are placed over one another and/or connected with one another and jointly subjected to a temperature increase, which leads to the formation of the spot and/or surface connection between the ceramic particles by the material.

10. Process according to claim 9, in which a material is used that forms a liquid phase during the temperature increase.

11. Process according to claim 9, in which a material is used whose liquid phase has a high surface tension.

12. Process according to claim 9, in which a material is used whose liquid phase partially or completely crystallizes during cooling.

13. Process according to claim 9, in which, when adding pulverized material to the ceramic slurries, it is distributed homogenously in the ceramic slurry and, after drying, is distributed homogeneously on the surface of the ceramic particles.

14. Process according to claim 9, in which the ceramic particles are wet with the material before manufacturing the ceramic slurry.

15. Process according to claim 14, in which the ceramic particles are wet with the material by means of chemical methods, preferably by co-precipitation.

16. Process according to claim 9, in which the temperature increase is carried out under air.

17. Process according to claim 9, in which the temperature is increased to a range between 700° C and 1200° C.

18. Process according to claim 9, in which the ceramic powders used are closely

fractionated abrasive powders.

Declaration and Power of Attorney For Utility or Design Patent Application

Erklärung für Patentanmeldungen zur Gebrauchseignung und Entwicklung
mit Vollmacht

German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

daß mein Wohnsitz, meine Postanschrift und meine Staatsangehörigkeit den im nachstehenden nach meinem Namen aufgeführten Angaben entsprechen, daß ich nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent für die Erfindung mit folgendem Titel beantragt wird.
KERAMISCHE MEHRSCHICHTENFILTER UND VERFAHREN ZU DEREN HERSTELLUNG

deren Beschreibung hier beigefügt ist, es sei denn (in diesem Falle Zutreffendes bitte ankreuzen), diese Erfindung

☒ wurde angemeldet am 3 Dezember 1999
unter der US-Anmeldenummer 09/856,495
und wurde am _____ abgeändert (falls zutreffend)
oder

☐ unter der PCT internationalen Anmeldungsnummer PCT/EP99/09479 und wurde am _____ abgeändert (falls zutreffend).

Ich bestätige hiermit, daß ich den Inhalt der oben angegebene Patentanmeldung, einschließlich der Ansprüche, die eventuell durch einen oben erwähnten Zusatzantrag abgeändert wurde, durchgesehen und verstanden habe.

Ich erkenne meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Titel 37, Code of Federal Regulations, § 1.56 von Belang sind.

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäß Title 35, US-Code, § 119 (a)-(d), bzw. § 365(b) aller unten aufgeführten Auslandsanmeldungen für Patente oder Erfinderurkunden, oder § 365(a) aller PCT internationalen Anmeldungen, welche wenigstens ein Land ausser den Vereingten Staaten von Amerika benennen, und habe nachstehend durch ankreuzen sämtliche Auslandsanmeldungen für Patente bzw. Erfinderurkunden oder PCT internationale Anmeldungen angegeben, deren Anmeldetag dem der Anmeldung, für welche Priorität beansprucht wird, vorangeht.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

CERAMIC MULTILAYER FILTERS AND METHOD FOR PRODUCING THE SAME

the specification of which is attached hereto unless the following box is checked:

☒ was filed on December 3, 1999 as
United States Application Number 09/856,495
and was amended on _____ (if applicable)
or,

☐ PCT International Application Number PCT/EP99/09479
and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority under Title 35, United States Code §119 (a-d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States, listed below. I have also identified below, by checking the "No" box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed:

Prior Foreign Applications Frühere ausländische Anmeldungen			Priority Claimed Prioritätsanspruch	
198 57 591.2 (Number) (Nummer)	Germany (Country) (Land)	14/December/1998 (Day/Month/Year Filed) (Tag/Monat/Jahr der Anmeldung)	☒ Yes Ja	☐ No Nein
_____ (Number) (Nummer)	_____ (Country) (Land)	_____ (Day/Month/Year Filed) (Tag/Monat/Jahr der Anmeldung)	☐ Yes Ja	☐ No Nein

☐ Zusätzliche einstweilige Anmeldungsnummern sind im Prioritätsanhang aufgeführt.

☐ Additional foreign application numbers are listed on a supplemental priority sheet attached hereto.

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Ich beanspruche hiermit Prioritätsvorteile unter Title 35, US-Code, § 119(c) aller US-Hilfsanmeldungen wie unten aufgezählt.

I hereby claim the benefit under Title 35, United States Code §119(e) of any United States provisional application(s) listed below.

(Application Number) (Aktenzeichen)	(Day/Month/Year Filed) (Tag/Monat/Jahr der Anmeldung)
(Application Number) (Aktenzeichen)	(Day/Month/Year Filed) (Tag/Monat/Jahr der Anmeldung)
(Application Number) (Aktenzeichen)	(Day/Month/Year Filed) (Tag/Monat/Jahr der Anmeldung)

☐ Zusätzliche einstweilige Anmeldungsnummern sind im ergänzenden Prioritätsanhang aufgeführt.

☐ Additional provisional application numbers are listed on a supplemental priority sheet attached hereto.

Ich beanspruche hiermit die mir unter Title 35, US-Code, § 120 zustehenden Vorteile aller unten aufgeführten US-Patentanmeldungen bzw. § 365(c) aller PCT internationalen Anmeldungen, welche die Vereinigten Staaten von Amerika benennen, und erkenne, insofern der Gegenstand eines jeden früheren Anspruchs dieser Patentanmeldung nicht in einer US-Patentanmeldung, bzw. PCT internationalen Anmeldung in in einer gemäß dem ersten Absatz von Title 35, US-Code, § 112 vorgeschriebenen Art und Weise offenbart wurde, meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Title 37, Code of Federal Regulations, § 1.56 von Belang sind und die im Zeitraum zwischen dem Anmeldetag der früheren Patentanmeldung und dem nationalen oder im Rahmen des Vertrags über die Zusammenarbeit auf dem Gebiet des Patentwesen (PCT) gültigen internationalen Anmeldetags bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s), or §365(c) of any PCT international application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

(Application No.) (Aktenzeichen)	(Day/Month/Year Filed) (Tag/Monat/Jahr eingereicht)	(Status) (patentiert, schwebend, aufgegeben) (patented, pending, abandoned)
(Application No.) (Aktenzeichen)	(Day/Month/Year Filed) (Tag/Monat/Jahr eingereicht)	(Status) (patentiert, schwebend, aufgegeben) (patented, pending, abandoned)

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The undersigned hereby authorizes the U.S. attorney or agent named herein to accept and follow instructions from either his foreign patent agent or corporate representative, if any, as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney or agent and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. attorney or agent named herein will be so notified by the undersigned.

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VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauf-trage ich hiermit den sich mit der Kundennummer befassenden Patentanwalt (Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent-und Warenzeichenamt und weise an, dass alle Korrespondenz mit dieser Kundennummer addressiert wird.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the attorney(s) and/or agent(s) associated with the Customer Number provided below to prosecute this application and transact all business in the Patent and Trademark Office connected therewith, and direct that all correspondence be addressed to that Customer Number:

KUNDENNUMMER 7055

CUSTOMER NUMBER 7055

Die ernannten Patenanwälte sind zur Zeit:

The appointed attorneys presently include:

Neil F. Greenblum	Reg. No. 28,394	Stephen M. Roylance	Reg. No. 31,296
Bruce H. Bernstein	Reg. No. 29,027	Leslie J. Paperner	Reg. No. 33,329
Arnold Turk	Reg. No. 33,094	William Pieprz	Reg. No. 33,630
James L. Rowland	Reg. No. 32,674	William E. Lyddane	Reg. No. 41,568

Address: **Greenblum & Bernstein, P.L.C.**
1941 Roland Clarke Place
Reston, VA 20191

Telefongespräche bitte richten an:

Direct Telephone Calls to:

Greenblum & Bernstein, P.L.C.
(703) 716-1191

Vor-und Nachname des einzigen oder ersten Erfinders. ADLER, Jörg	Full name of sole or first inventor ADLER, Jörg
Unterschrift des Erfinders Datum 6.9.01	Inventor's signature Date 6.9.01
Wohnsitz Meißen, Deutschland	Residence Meissen, Germany
Staatsangehörigkeit Deutschland	Citizenship Germany DEX
Postanschrift Schloßstufen 2, D-01662 Meissen, Deutschland	Post Office Address Schlossstufen 2, D-01662 Meissen, Germany
Vor-und Nachname des zweiten Miterfinders (falls zutreffend) LENK, Reinhard	Full name of second joint inventor, if any LENK, Reinhard
Unterschrift des zweiten Erfinders Datum 3.9.01	Second Inventor's Signature Date 3.9.01
Wohnsitz Großschönau, Deutschland	Residence Grossschönau, Germany
Staatsangehörigkeit Deutschland	Citizenship Germany DEX
Postanschrift Buchbergstrasse 12, D-02779 Großschönau, Deutschland	Post Office Address Buchbergstrasse 12, D-02779 Grossschönau, Germany
(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).	(Supply similar information and signature for third and subsequent joint inventors).

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Vor-und Nachname des dritten Miterfinders: RICHTER, Hans-Jürgen	3 OP Full name of third inventor, if any RICHTER, Hans-Jürgen
Unterschrift des dritten Erfinders Datum Hans-Jürgen Richter 30.08.07	Third Inventor's signature Date Hans-Jürgen Richter 30.08.07
Wohnsitz Dresden, Deutschland	Residence Dresden, Germany
Staatsangehörigkeit Deutschland	Citizenship Germany DEX
Postanschrift Bismarckstrasse 1, D-01257 Dresden, Deutschland	Post Office Address Bismarckstrasse 1, D-01257 Dresden, Germany
Vor-und Nachname des vierten Miterfinders (falls zutreffend)	Full name of fourth inventor, if any
Unterschrift des vierten Erfinders Datum	Fourth Inventor's Signature Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address
Vor-und Nachname des fünften Miterfinders (falls zutreffend)	Full name of fifth inventor, if any
Unterschrift des fünften Erfinders Datum	Fifth Inventor's Signature Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address
Vor-und Nachname des sechsten Miterfinders (falls zutreffend)	Full name of sixth inventor, if any
Unterschrift des sechsten Erfinders Datum	Sixth Inventor's signature Date
Wohnsitz	Residence
Staatsangerhörigkeit	Citizenship
Postanschrift	Post Office Address
(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).	(Supply similar information and signature for seventh and subsequent joint inventors).